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EP 0743590 A2 US 5138118 A US 4963703 A
US 4748295 A

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(54) Abstract Title
Cordless digitizer

(57) A cordless digitizer with a cordless cursor/pen having a power supply of the battery type and comprising a winding-type transducer coil (11,12), a tablet with a winding-type sensor winding coil (21) provided parallelly on or under a plurality of conductive loops (22,23), a thin-filmed key-pad, and a signal-processing circuit (31) connected to the tablet to obtain the key-in state and the location of the cursor/pen. The cordless digitizer further comprises a touch control switch which can automatically switch the power on or off according to whether or not the user's hand is touching the contact points of the touch control switch for extending the battery life when the cordless cursor/pen is not in use (see Figure 4).

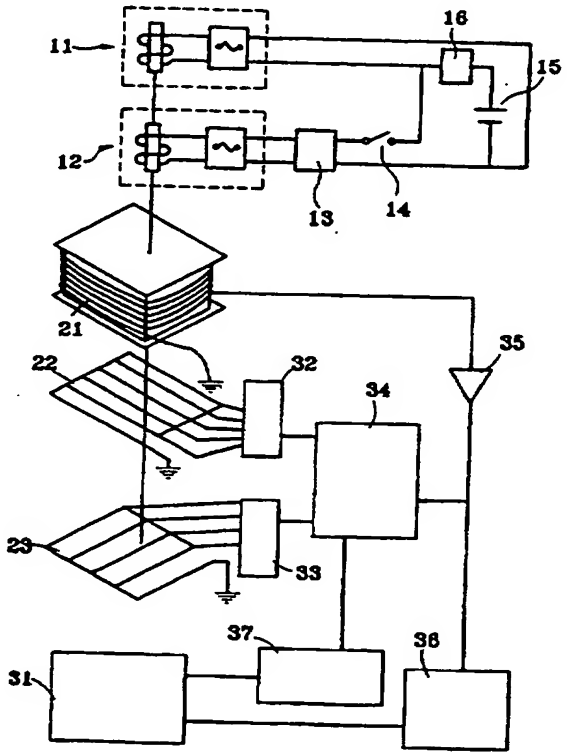

Fig. 2

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CORDLESS DIGITIZER

This invention relates to a cordless digitizer comprising a cordless cursor/pen, a tablet and a signal-processing circuit. The cordless cursor/pen comprises a winding-type transducer coil, a touch control switch and a plurality of switches. The tablet comprises a thin-filmed key-pad, a plurality of conductive loops and a winding-type sensor coil. The signal-processing circuit adapted for processing the interactive signals between the cordless pen/cursor and the tablet.

The prior art of this invention is described in the U.S. Pat. No. 3,647,963 "AUTOMATIC COORDINATE DETERMINING DEVICE". there is a coaxial cable attached to the cursor/pen. The coaxial cable of the cursor/pen is not friendly to the user. For this reason, a digitizer without the coaxial cable connecting the cursor/pen to a tablet of the digitizer (the cordless-type cursor/pen) had been developed in the U.S. Pat. No. 4,795,858 "DEVIVE FOR DETERMINING POSITION COORDINATES OF POINTS ON A SURFACE", U.S. Pat. No. 5, 124,509 "DIGITIZER WITH CAPACITIVE AND INDUCTIVE INDUCTIVELY COUPLING", U.S. Pat. No. 5,160,813 "CORDLESS DIGITIZER LOCAL CONDUCTOR REFERENCE PHASE SYSTEM", and U.S. Pat. No. 5,345,044 "CORDLESS DIGITIZER USING ELECTROMAGNETIC LOCATING SIGNALS". According to the necessity of a signal-processing circuit of the tablet, the position signal with reference phase and state signals showing key-in state of a general digitizer are obtained from the auxiliary conductive loops in the P.C.B. coupling from the cursor/pen. The inductively coupling signal is very weak when the number of the auxiliary conductive loops is limited. More auxiliary conductive loops need the larger P.C.B. or increasing the levels of the P.C.B.. This will increase the cost of production.

Besides, cursor/pen generally comprises one winding-type transducer coil and one tip switch. According to U.S. Pat. No. 5,138,118 "PULSE PEN FOR USE WITH A DIGITIZER TABLET", the winding-type transducer coil not only generates the

position signal with reference phase inductively coupling to a plurality of conductive loops but also generates the state signals showing the key-in states. Generally the state signals is generated on the tablet after the modulation of position signal. There is a small perturbation of the phase or amplitude of the modulated position signal. In detecting the phase inversion to decide the location of the cursor/pen system, the change of the key-in state generating a small perturbation of the phase or amplitude of position signal will cause the small deviation of the location of the cursor/pen. The plurality of conductive loops cannot inductively coupling the correct signal from the winding-type transducer coil to decide the exact location of the cursor/pen when the voltage of the battery is not high enough . It is necessary to frequently replace the battery for a new one, because the cordless digitizer with the battery type power supply continuously losses its power even the cordless digitizer is not in use. This will reduce the life of the battery.

For this reason, it is the main object of this invention providing a cordless digitizer comprising a cordless cursor/pen, a tablet, and a signal-processing circuit. The cordless cursor/pen comprising two winding-type transducer coils, touch control switch and a plurality of switches. The tablet comprising thin-filmed key-pad, plurality of conductive loops and sensor winding coil. The signal-processing circuit adapted for processing the interactive signals between the cordless cursor/pen and the tablet. One of the winding-type transducer coils generates the position signal with reference phase and the other one generates the state signals in application. The state signals are not necessary to modulate the position signal and to generate small perturbation of the phase or amplitude of position signal that will affect the accuracy of the location of the cursor/pen . Owing to the small diameter of the insulated wire, it is easy to wind the insulated wire over than 50 turns for winding-type sensor coil inductively coupling the enough intensity of the positional signal with reference phase and state signals. This will decrease the cost of production.

It is another object of this invention comprising a thin-filmed key-pad provided on the tablet to perform the function of the tip switch of a pen or the right button of a cursor and thereby eliminate the need for the installation of a tip switch and one

winding-type transducer coil. Besides, the touch control switch of the cursor/pen can also extend the life of the battery.

The present invention will now be described by way of example with reference to the annexed drawings, in which:

FIG. 1 is a simplified block diagram drawing according to the present invention;

FIG. 2 is a detailed block diagram drawing according to the present invention ;

FIG. 3 is another simplified block diagram drawing according to the present invention;

FIG. 4 is a block diagram drawing according to the present invention of power saving device of cursor/pen.

Referring to the various drawings attached herewith, a detailed description of the structural features of "CORDLESS DIGITIZER" of the present invention is as follows:

In FIG. 1, 2, there is a simplified and detailed block diagram drawing according to the present invention for use in a cordless digitizer comprising a cursor/pen 1 having a transmission device, tablet 2, and a signal-processing circuit 3. The cursor/pen 1 comprising a position signal generating circuit 11, a state signals generating circuit 12 , a modulator 13 ,a plurality of switches 14, and a battery 15. The cursor/pen 1 is put on the surface of the tablet 2. The position signal generating circuit 11 generates an AC magnetic field with reference phase and the state signals generating circuit 12 generates an AC magnetic field with key-in states. The tablet 2 comprising a winding-type sensor coil 21, first conductive loops 22, and second conductive loops 23. The first conductive loops 22 connects to a first multiplexer 32. Similarly, the second conductive loops 23 perpendicularly connects to a second multiplexer 33. One of the conductive loops scans for the X-axis and the other one scans for the Y-axis. The working area is decided by the two conductive loops laid two sides of the P.C.B. Beside that, a flat frame wound by the insulated wire which is larger than the working area in size is necessary for good performance and easy to be placed in the tablet 2. When designing the winding-type sensor coil 21 of the tablet 2, it should be wound by the insulated wire from the outside of the frame and be placed

parallelly on or under the two conductive loops 22 and 23. When using the cursor/pen 1 moving on the tablet 2, the position signal generating circuit 11 and state signals generating circuit 12 will be always moving inside of the frame generating the position signal with the reference phase and the state signals showing the key-in states.

The signal-processing circuit 3 comprising a first multiplexer 32, a second multiplexer 33, a amplifier 35, a phase modulator 34, a key-in signals detector 36, a V to F converter 37, and a microprocessor 31. The outputs of the first multiplexer 32 and second mulitiplexer 33 are all connected to the phase demodulator 34 which detects the phase inversion. The output of the position signal with reference phase coupled by the winding-type sensor coil 21 connects to the amplifier 35. The output of the amplifier 35 connects to the phase demodulator 34. The output of the phase demodulator 34 provides a signal to the V to F converter 37, then to the microprocessor 31 to obtain the exact location of the cursor/pen 1 on the tablet 2. The split signal of the output of the amplifier 35 connected to the key-in signals detector 36 to detect the state signals from a plurality of switches 14 and send them to the microprocessor 31 to obtain the key-in states. The frequency of the position signal and the state signals are different. The different key-in state signals can be generated after the modulator 13 modulates the (AM、FM、PM) carrier signals in case that the cursor/pen 1 comprises no less than one switch to generate no less than one key-in signal.

In FIG. 3, there is another simplified block diagram according to the present invention for use in a cordless digitizer, comprising a cursor/pen 1', a tablet 2, and thin-filmed key-pad 5. The cursor/pen 1' comprising a position signal circuit and a battery (not mentioned in the figure). The above mentioned structure including a thin-filmed key-pad 4 provided on the tablet 2. The thin-filmed key-pad 4 transfers the state signal when the cursor/pen 1' touches the thin-filmed key-pad 4 to replace the above-mentioned function of the said tip switch or the right button of a cursor.

In FIG.4, there is a block diagram according to the present prevention of power saving device of a cursor/pen comprising the above-mentioned cursor/pen 1、1' with a touch control switch 16 . The touch control switch 16 comprising open contact points 161、162 . When a user use his hand to touch the two contact points 161、162, the hand will work as a human resistance 164 to enable the touch control switch 16 to supply power. For this reason, it is in an open-circuit condition of the battery type power supply when the hand does not touch the cursor/pen because of the removal of the human resistance 164. This can extend the battery life and be easy for users.

Claims:

1. A cordless digitizer comprising:

a) a transmission device of a cursor/pen to transmit different frequencies of position signal with reference phase and state signals;

b) an inductively coupling device comprising winding-type sensor coil and a plurality of conductive loops provided in a tablet;

c) a signal-processing circuit to process said position signal with reference phase and said state signals inductively coupling on said winding-type sensor coil and said position signal with reference phase inductively coupling on said plurality conductive loops and to obtain the exact location and action message of said cursor/pen.

2. The cordless digitizer of claim 1, wherein said transmission device comprises two conductor contact points installed thereon, the hand of a user work as a human resistance between said two conductor contact points when the hand contact said two conductor contact points, thereby enable the battery type power supply to supply power.

3. The cordless digitizer of claim 1, wherein said position signal with reference phase is generated from a winding-type transducer coil.

4. The cordless digitizer of claim 1, wherein said state signals are generated from a winding-type transducer coil which is controlled by a modulator.

5. The cordless digitizer of claim 1, wherein said winding-type sensor coil should be wound by the insulated wire from the outside of the defined working area and be provided parallelly on or under said plurality of conductive loops for inductively coupling enough intensity of said position signal with reference phase and said state signals.

6. A cordless digitizer comprising:

a) a transmission device in a cursor/pen to transmit the different frequencies of position signal with reference phase and state signals;

b) an inductively coupling device comprising winding-type sensor coil and a plurality conductive loops provided in a tablet;

c) a thin-filmed key-pad on said tablet, which can confirm the action message of the pen action for the system when the pen tip touches thereon;

d) a signal-processing circuit to process the said position signal with reference phase inductively coupling on said winding- typing sensor coil, said action message of said thin-filmed key-pad and said position signal with reference phase inductively coupling on said plurality conductive loops and to obtain the exact location and said action message of said cursor/pen.

7. The cordless digitizer of claim 6, wherein said transmission device comprises two conductor contact points installed thereon, the hand of a user works as a human resistance between said two conductor contact points when the hand contact said two conductor contact points, thereby enable the battery type power supply to supply power.

8. The cordless digitizer of claim 6, wherein said position signal with reference phase is generated from a winding-type transducer coil.

9. The cordless digitizer of claim 6, wherein said winding-type sensor coil should be wound by the insulated wire from the outside of the defined working area and should be provided parallelly on or under said plurality of conductive loops for inductively coupling enough intensity of said position signal with reference phase.

10. The cordless digitizer of claim 6, wherein the conductive planes of said thin-filmed key-pad is made of a conducting material which cannot shield the AC magnetic field.

11. The cordless digitizer of claim 6, wherein said thin-filmed key-pad and said plurality conductive loops can be made of the same material, and can put said thin-filmed key-pad under said plurality conductive loops.

12. A cordless digitizer substantially as hereinbefore described with reference to the accompanying drawings of Figures 1, 2, 3 and 4.

The Patent Office

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Application No: GB 9726578.9
Claims searched: 1-12

Examiner: Steven Davies
Date of search: 8 April 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): G1N-NAQB

Int Cl (Ed.6): G06K-11/16,11/18

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
Y	EP 0743590 A2 (WACOM) e.g. Figure 4	6-8
Y	US 5138118 (RUSSELL) e.g. Figure 2	4
X,Y	US 4963703 (PHILLIPS et al) e.g. column 3, line 8-column 4, line 18	X: 1,3 Y: 2,4,6-8
Y	US 4748295 (ROGERS) e.g. Figure 1	2,7

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.
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A Document indicating technological background and/or state of the art.
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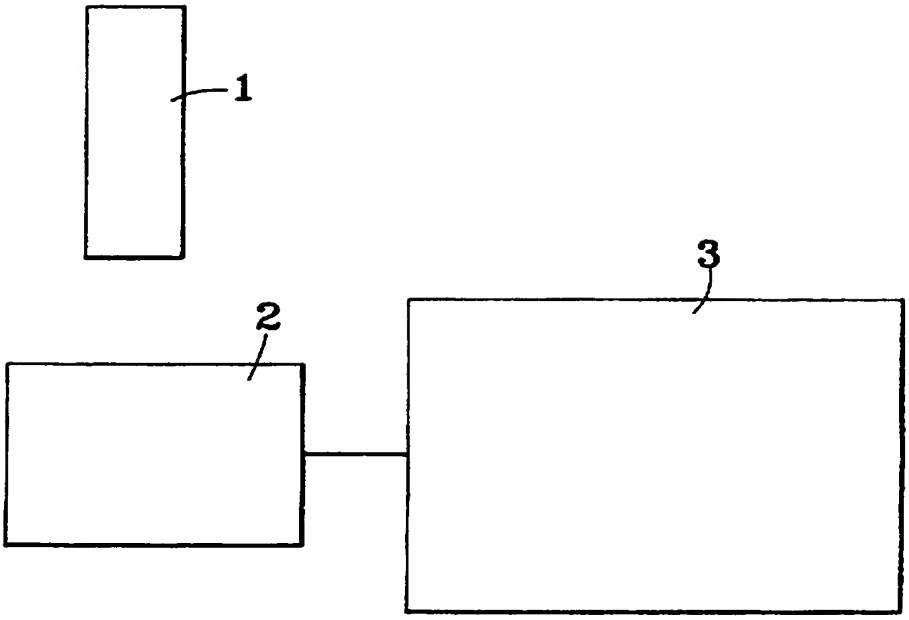

Fig. 1

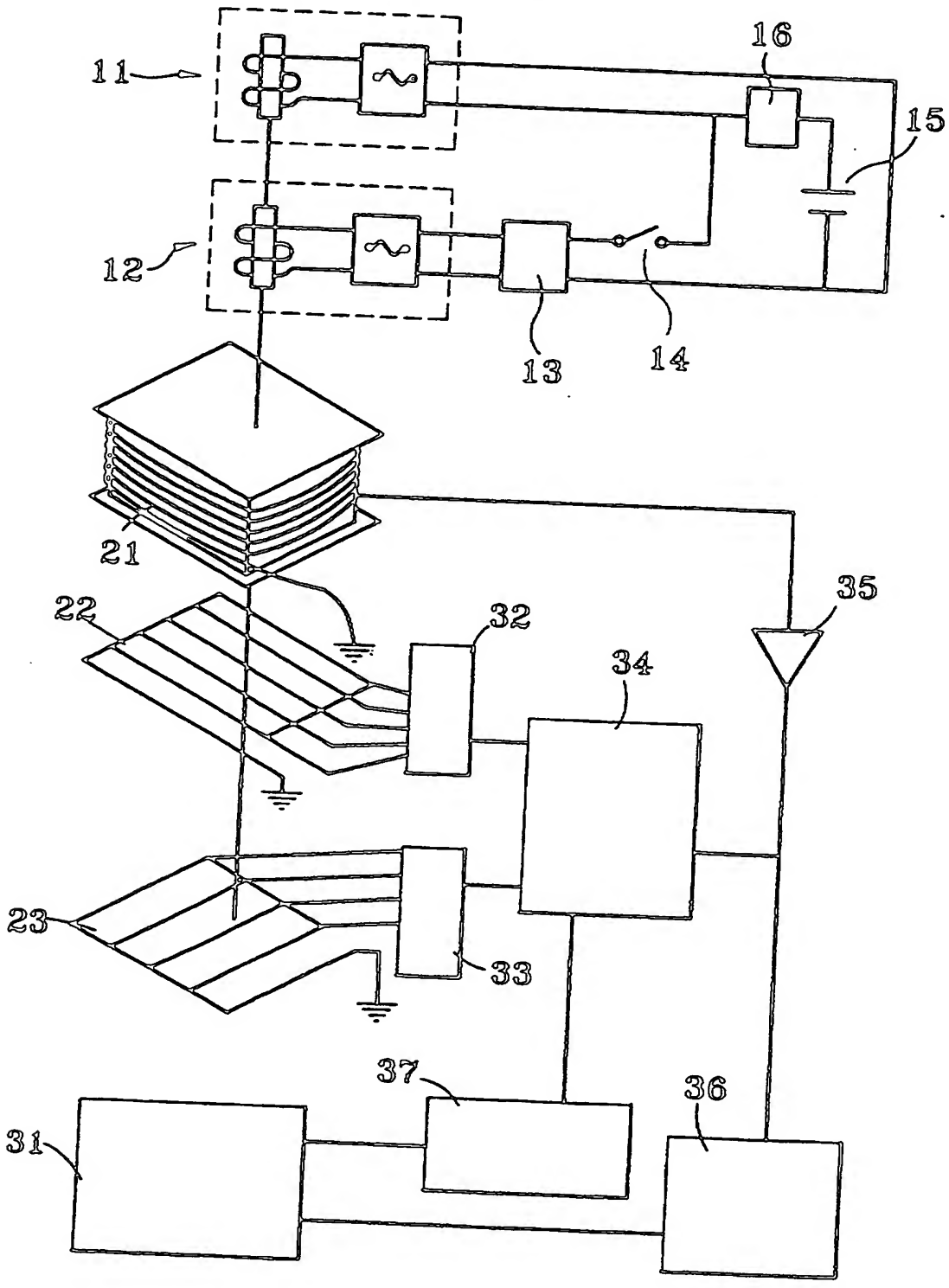

Fig. 2

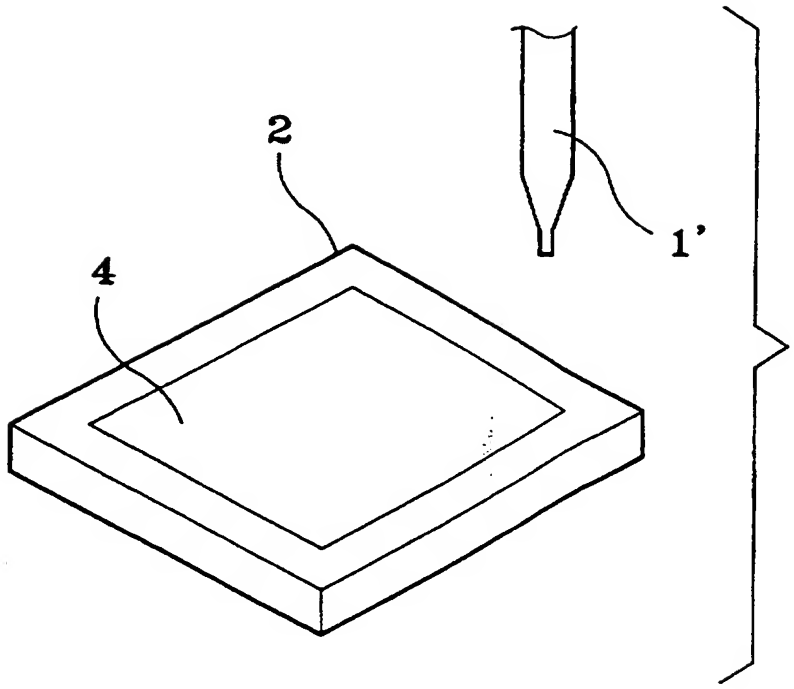

Fig. 3

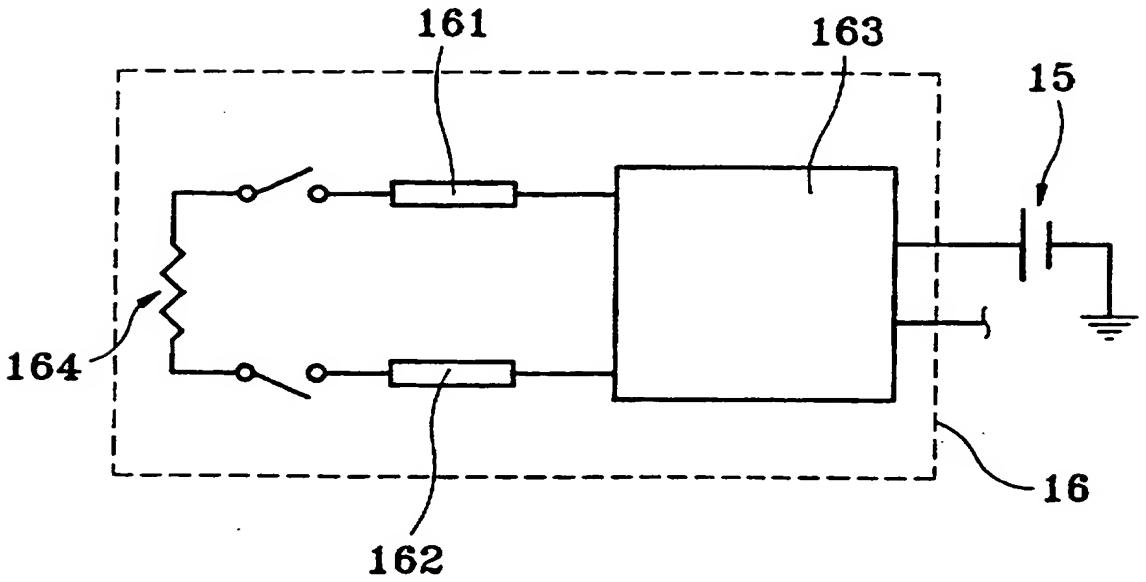

Fig. 4